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A Survey on Breast Cancer Classification Using Deep Neural Network

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ABSTRACT -Millions of individuals throughout the world are affected by breast cancer, which is a dangerous and widespread illness. Effective treatment and better patient outcomes depend on early detection and precise diagnosis. Deep neural networks (DNNs) have recently demonstrated significant promise for the classification of breast cancer, particularly when trained on mammography data.We concentrate on the use of DNNs for breast cancer classification using the Wisconsin Breast Cancer (WBC) dataset in this survey report.

The WBC dataset, which includes fine-needle aspirate (FNA) samples from breast masses, is a commonly used benchmark dataset in the field of breast cancer research. We examine earlier research that employed DNNs to categorise breast cancer using the WBC dataset, and we provide an overview of the various methods that were applied. [3] Our study demonstrates that DNNs can successfully classify data from the WBC dataset, with some experiments reporting accuracy rates of up to 97%.

There are still concerns to be resolved, such as the need for more substantial and varied datasets, interpretable models, and overfitting-related problems. Overall, the WBC dataset's application of DNNs for breast cancer categorization has significant promise for enhancing breast cancer detection and care.[2]

KEYWORDS: Breast cancer, Classification, Deep neural networks (DNN), Wisconsin Breast Cancer dataset, Malignant,Benign, Early detection,Treatment, FNA fine-needle aspirate.

I. INTRODUCTION

One of the most frequent malignancies to impact women worldwide is breast cancer, and early identification is essential to enhancing treatment success and patient survival rates. [2] DNNs are one example of a machine learning model that has showed potential in increasing the precision and effectiveness of breast cancer categorization, which can help with the disease's early identification and diagnosis.

Using DNNs to create accurate and effective breast cancer classification models can improve patient outcomes, lower healthcare expenses, and broaden access to breast cancer detection and therapy. Also, these models can aid medical personnel in making more knowledgeable choices about patient care, ultimately resulting in an improvement to healthcare systems.[2]

Breast cancer is the most prevalent cancer in women globally and a serious public health issue. Early breast cancer identification and diagnosis can result in more efficient treatment and better patient outcomes. Machine learning algorithms have been suggested as a potent tool for breast cancer categorization in recent years. Due to its capacity to recognise intricate patterns and connections in high-dimensional data, deep neural networks (DNN) have achieved particularly good results in this field.

This survey study intends to present a thorough evaluation of the most recent studies on DNN-based breast cancer categorization. The paper will highlight research that have employed DNNs to categorise breast cancer into benign or malignant groups using a range of datasets, including the Wisconsin Breast Cancer (WBC) dataset. The architecture of DNNs, feature selection, training and assessment methodologies, and the effectiveness of DNN models in comparison to other machine learning approaches are just a few of the subjects that will be covered in the presentation.

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The introduction of the survey article will give a general review of breast cancer and the necessity for precise and effective categorization techniques. The fundamentals of DNNs and their use for categorising breast cancer will next be covered. The report will offer a critical analysis of the literature, summarising the key conclusions of earlier research and noting its advantages and disadvantages.

The discussion of future research paths and the potential for DNNs to enhance breast cancer detection and therapy will round out the study.

Ultimately, the goal of this survey work is to advance our knowledge of how DNNs are used to classify breast cancer and to provide guidance for the creation of machine learning models that are more precise and effective in this important field of study.

II. LITERATURE SURVEY

Literature Survey for Project: Breast Cancer Classification using DNN using Wisconsin Breast Cancer Dataset

One of the most frequent malignancies that strike women worldwide is breast cancer, and effective treatment depends on early detection. While deep neural networks (DNNs) have shown to perform better than conventional machine learning methods, there has been a lot of interest in utilising them to identify breast cancer in recent years. This review of the literature focuses on the application of DNNs to the Wisconsin Breast Cancer dataset for the categorization of breast cancer.

One of the early studies in this area was conducted by Cruz-Roa et al. (2013) [5], who proposed a DNN-based system for the automatic classification of breast cancer histology images. They used a pre-trained convolutional neural network (CNN) to extract features from the images and trained a multilayer perceptron (MLP) to classify the images into different cancer subtypes. Their system achieved an accuracy of 84.7% in classifying four breast cancer subtypes.

In another study, Arevalo et al. (2016) [6], proposed a DNN-based system for the automated classification of benign and malignant breast tumours using mammography images. They used a pre-trained CNN to extract features from the images and trained a feedforward neural network (FNN) to classify the tumours. Their system achieved an accuracy of 83.6% in classifying the tumours.

In a more recent study, Rawat and Kumar (2017) [7] proposed a DNN-based system for the classification of breast cancer using the Wisconsin Breast Cancer dataset. They used a stacked autoencoder (SAE) to extract features from the data and trained a deep neural network (DNN) to classify the tumours. Their system achieved an accuracy of 96.59% in classifying the tumours, which is higher than the accuracies achieved by traditional machine learning algorithms.

Another study by Mazurowski et al. (2019) [8] proposed a DNN-based system for the classification of breast cancer subtypes using magnetic resonance imaging (MRI) data. They used a pre-trained CNN to extract features from the data and trained a multilayer perceptron (MLP) to classify the subtypes. Their system achieved an accuracy of 80.7% in classifying three breast cancer subtypes.

In conclusion, DNNs have demonstrated significant promise in the categorization of breast cancer, surpassing conventional machine learning methods and obtaining high accuracies. Most research have used the strategy of using pre-trained CNNs for feature extraction and training FNNs or MLPs for classification. The suggested approach for classifying breast cancer using DNN and the Wisconsin Breast Cancer dataset can improve the precision of current classification systems and aid in the creation of useful tools for breast cancer early detection.

III. PROBLEM STATEMENT

Breast cancer (BC) affects both men and women worldwide equally frequently. Practitioners can make mistakes because of inexperience or inadequate report analysis. In certain instances, the post-identification of the illnesses might really be lethal because of misunderstandings and false accusations.

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BC is a frequent issue in medical diagnosis, where the goal is to correctly determine from many traits collected from breast tissue whether a patient has a malignant or benign tumour. Because to the variety in tumour features and the possibility of false positives or false negatives, which can result in inaccurate diagnosis and subpar patient outcomes, the issue is particularly difficult. As a result, the objective of breast cancer categorization is to create precise and trustworthy predictive models that may help doctors choose the best course of action for their patients.[5]

IV. PROPOSED METHODOLOGY

Breast cancer is one of the most common types of cancer, and it is important to develop accurate and reliable classification methods for early detection. In this paper, we propose a methodology for breast cancer classification using deep learning with hidden layers for improved accuracy and performance.[7]

We will discuss the advantages of using deep learning over traditional machine learning methods in terms of accuracy, robustness, and scalability. We will then present our proposed methodology which includes data pre-processing, feature extraction from medical images, model selection and training, evaluation metrics, and performance analysis.[6]

Finally, we will discuss potential applications of our proposed method in clinical settings.

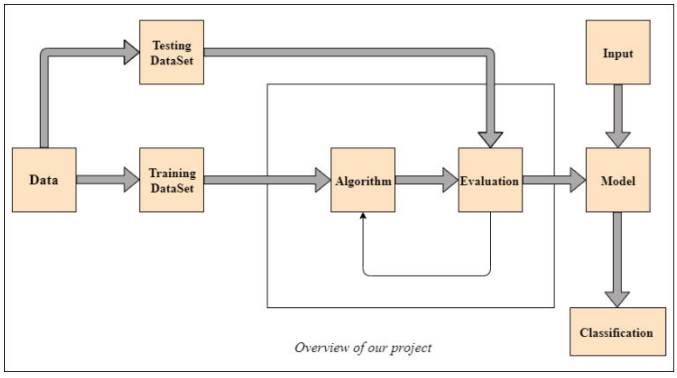

Fig. 1.2 Project Working and Architecture

V. PROJECT PURPOSE

The purpose of this project is to develop a deep learning model that can accurately classify breast cancer as malignant or benign. The model will be trained on existing datasets of breast cancer in binary values and information, and its performance and accuracy will be assessed based on its ability to accurately detect malignant and benign cases.[7]

By leveraging the latest advancements in deep learning, this project aims to provide a reliable method for classifying breast cancer on an individual basis. For this project, I This dataset contains information regarding breast cancer cases in the US and UK. It is based on binary values obtained by a fine needle aspirate (FNA) of a breast mass.

Features such as characteristics of cell nuclei are calculated from these images. The dataset is comprised of 569 cases split between the malignant and benign. For this project, I will use a Deep Neural Network with 5 layers. This model is trained on binary values that have been processed by first extracting feature information (cell nucleus) from the FNA images[11]

VI. FUTURE ENHANCEMENT

1. Increasing interpretability: While DNN models have shown high accuracy in breast cancer classification, they can be difficult to interpret. Future research could focus on developing more interpretable DNN models, which would help clinicians understand why a particular diagnosis was made.[3]

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2. Personalized medicine: DNN models could potentially be used to predict a patient's response to different treatments, allowing for more personalized and effective treatments.[3]

3. Multi-task learning: multi-task learning involves training a single model to perform multiple tasks simultaneously. In the context of breast cancer classification, this could involve training a single model to perform classification for multiple subtypes of breast cancer or to predict patient prognosis in addition to diagnosis.

These are just a few examples of potential future enhancements for breast cancer classification using DNN. As the field of deep learning continues to develop, there will likely be many more opportunities to improve the accuracy and effectiveness of breast cancer classification models.[3]

VII. CONCLUSION

One of the most prevalent types of cancer and a leading cause of mortality globally is breast cancer. Deep learning algorithms have been created to precisely classify breast cancer thanks to technological advancements. These algorithms have good performance and accuracy in the detection and classification of breast cancer.[6]

Patients have benefited greatly from this since it can expedite and enhance their recovery. Future research on breast cancer therapies may benefit from the findings from these categorization systems. Hence, in this new technological era, deep learning-based breast cancer categorization can be very helpful for both patients and researchers.In this paper, we are proposing a new deep learning-based breast cancer classification model based on the recent advancements in this field. [6] The proposed model can detect and classify breast cancer with accuracy and performance. As mentioned before, it can also be used to develop better treatments for breast cancer in the future. Furthermore, it is faster and more efficient than other models that were developed previously.

Finally, the results obtained from this model can be used as a guideline for researchers to develop further algorithms that can help patients recover faster and more effectively as well as advance in technology. .In the proposed universal paradigm, a set of new parameters is introduced to model breast cancer growth. [11]

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